RCEA
(SUSSEX)

An Association for Retired Professional Engineers

NEWSLETTER December 2022

President's message

Hello everyone, and a warm welcome to the Christmas Newsletter.
We are now back up and running after the Pandemic that rocked the world: social distancing and constant wearing of masks seems a distant past, but we must be mindful that Covid has not gone away. After the jabs it is, thankfully, not like it used to be and life is slowly getting back to some normality.
Following the AGM in September we have had a full programme of talks that have been attended, on average, by 32 – 33 members and guests. The hard work of my fellow Committee members also means that we have had things 'up our sleeve' should something have to be changed at the last minute, as was the case in October, when our speaker was unavoidably not available a few days before the event.
I then had another curved ball thrown at me when the Windsor Hotel, the venue for our Christmas Lunch for many years, announced their closure. So, the hunt began for a new location. This has ended up to be the Roundabout Hotel in West Chiltington, and in early December we will experience for the first time what they have to offer. The numbers are up on previous years, so we look forward to the event with interest.
Next year our programme of talks continues, but help is still needed. As in all organisations, a few do a lot and there are still spaces on our committee if you wish to join in to help form the association into what you want it to be.
I would like at this point to thank all the existing committee members for the help and support they have given me in arranging all the talks: this takes a lot of planning and phone calls to get the 'correct people'.
Finally, may I wish you and your families a very Merry Christmas and a Happy and Healthy New Year, and look forward to the continuing support of all of you who keep our association up and running.

George Woollard

President
December 2022

PROGRAMME OF EVENTS December 2022 – April 2023

8th Dec	**Thursday**	**Christmas Lunch at Roundabout hotel, West Chiltington**
13th Dec	**Tuesday**	**Talk – The design challenges of building modern lifeboats for the RNLI**
15th Dec	**Thursday**	**Coffee – at Spotted Cow, Angmering**
29th Dec	**Thursday**	**Coffee – with Partners at Swallow's Return**
10th Jan	**Tuesday**	**Talk – The TT races from an engineering perspective**
19th Jan	**Thursday**	**Coffee – at Spotted Cow, Angmering**
26th Jan	**Thursday**	**Coffee – with Partners at Swallow's Return**
14th Feb	**Tuesday**	**Talk – Military Target acquisition**
16th Feb	**Thursday**	**Coffee – at Spotted Cow, Angmering**
23rd Feb	**Thursday**	**Coffee – with Partners at Swallow's Return**
14th Mar	**Tuesday**	**Talk – HS1, Crossrail and HS2 from a traction power perspective - TBC**
16th Mar	**Thursday**	**Coffee – at Spotted Cow, Angmering**
30th Mar	**Thursday**	**Coffee – with Partners at Swallow's Return**
11thApr	**Tuesday**	**Talk by Dudley Hooley – subject TBC**
20th Apr	**Thursday**	**Coffee – at Spotted Cow, Angmering**
27th Apr	**Thursday**	**Coffee – with Partners at Swallow's Return**

All Talks and Meetings will commence at 2.30 pm and are held in the Pavilion, Field Place, Worthing unless another venue or time is indicated. Timings for visits and outings will be as printed in the detailed description of the activity.

Coffee mornings commence at 10.30 am.

We have noticed that the number of members attending our coffee mornings has declined recently. To enable us to continue to offer these coffee mornings, please support them, and in the case of the one at the Swallows Return, please encourage your partner to come along as well, as it is a very good opportunity for partners to meet each other in a relaxed setting.

We apologise for only being able to publish a very short list of our forthcoming events. As you know we sometimes have to cancel/rearrange talks and visits, often at short notice. We do try and inform our members of late changes to our programme by email, but suggest that members should increasingly rely upon our website for up-to-date details of events.

Website of the RCEA

Our website, **www.rceasussex.org.uk** carries the very latest information on all of our events.

New Members and Speakers for Talks

The RCEA needs new members and speakers to ensure that we can continue as a thriving organisation. Please think of appropriate people you know and encourage them to come along to our talks and hopefully join the RCEA.
We also need more speakers to give talks to us on Tuesday afternoons from September to March/April. We are aware that many members have the knowledge from their working careers to provide interesting talks. If you are willing to give a talk, please let us know. Speakers from outside organisations are increasingly harder to find and often seek payment for their services.

New Members

A. Allison, BEng CEng CEnv MCIWEM MICHT	Arundel, West Sussex
R. Arthur, CEng, MIET	Storrington, West Sussex
J. Eaton, BSc (Eng)	Shoreham by Sea, West Sussex
M. Phillips, BSc Eng, (was MIEE and CEng)	Shoreham by Sea, West Sussex

RCEA Insurance

Members need to be aware that the insurance policy that the Association holds is solely for the protection for the assets and liabilities for the Association as an entity. The policy does not provide cover for personal injury or loss to individual members. Members attend the Association's events at their own risk; although under some circumstances there may be some cover from the insurance arrangements of the venue owner.

Newsletter Entries

If you would like to provide an article for inclusion in a future newsletter it would be very welcome as we are always looking for new material in addition to reports on previous talks and visits/outings. From feedback from our members, we know that the newsletter is particularly appreciated by those who are no longer able to get to our meetings and visits, so if you are able to contribute in this way it would be much appreciated. Articles should preferably be Microsoft Word documents, although we can usually convert both text and pictures (even photographs) into a suitable format. Accompanying pictures are best supplied as separate files which will be embedded within the text during editing.

Brief Detail – Talks, Outings and other activities January 2023 – March 2023

Talk

Tuesday, 13th December 2022 – The design challenges of building modern lifeboats for the RNLI

Iain Wallbridge BEng (Hons), CEng, MRINA, MSNAME, Senior Naval Architect, RNLI, West Quay Road, Poole, Dorset, BH15 1HZ

Modern lifeboats have to be capable of safely and reliably operating in the most extreme of natural environments.

In addition to these obvious challenges, RNLI Engineers have to consider social, legislative and organisational challenges when designing new RNLI equipment.

This presentation will describe some of the challenges faced by RNLI engineers when designing lifeboats and their launching systems for operation around the coastlines of the UK and Republic of Ireland.

Iain will also discuss the recently announced life extension programme for the Severn Class lifeboat, which is the RNLI's largest craft.

Talk

Tuesday, 10th January 2023 - The TT races from an engineering perspective

Malcolm Hind - member

TT stands for Tourist Trophy and the TT races are held each year on the Isle of Man, or to give it its correct Manx name, Ellan Vannin.

In this talk, the speaker will look at the technical innovations that motorcycle manufacturers introduced to make their race bikes more competitive. Many of these developments eventually found their way onto the motorcycles that you can buy today.

Malcolm has a past career in the automotive industry and has always had an in interest in two wheels which he has ridden all over Europe, has attended the TT and has worked at Honda's R&D centre in Japan.

He will cover developments from the very early days when the TT started in 1907, to the present day where lap speeds and machine reliability have advanced enormously, due to both the technology of the machines themselves and to the major course improvements introduced on the island over the last 100+ years.

Talk
Tuesday, 14th February 2023 – Artillery Target acquisition
Eddie Bridges, BSc (Hons) Environmental Management - member

Our speaker began his career instructing in the Royal Artillery as a Staff Officer, and has served in the UK, Germany, Sarawak and Oman. Later he became responsible for Environmental Protection within the MOD.

He will give a brief history of the gun from before the discovery of gunpowder right through to the present day, and the subsequent need to acquire targets.

The use of artillery became a major feature of the First World War. There was still a siege mentality with opposing forces dug in using bombardment to wear down the enemy, destroy his facilities, cause casualties, crush morale and subsequently destroy his ability to fight the war. He will also discuss the advent of "Air Spotters", "Flash Spotting" and "Sound Ranging" during that war.

Target acquisition technology remained fairly static until the early 1960's when radar was introduced to locate enemy mortars, and drones first came into service. He will discuss methods used, deployments and improvements in Sound Ranging technology which was introduced in the late 1960's. Jet-assisted take off drones with pre-planned flight paths were introduced in the early 1970's. He will conclude with a look into the future of gun-locating radar and free-flight drones.

Talk (TBC)
Tuesday, 14th March 2023 – HS1, Crossrail and HS2 from a traction power perspective
Louise Moore and Davor Vujatovic

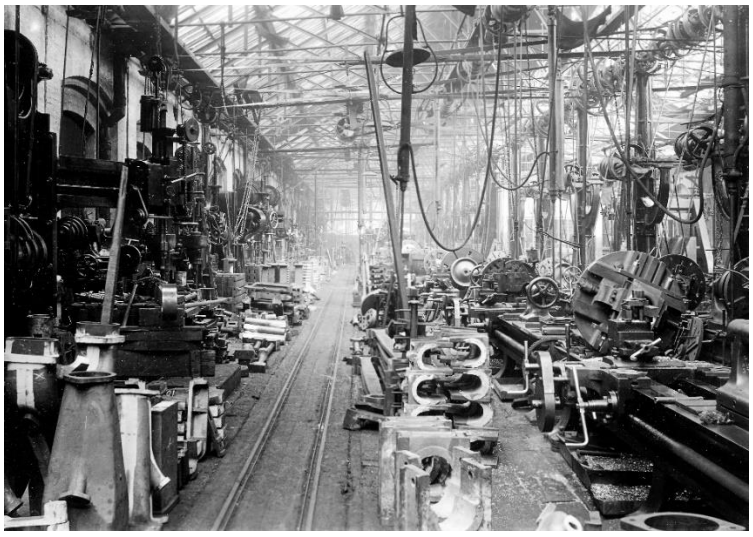
Ms. Louise Moore and Dr. Davor Vujatovic will present on their experience in the design and delivery of brand-new AC railway projects in the UK over the last 20 years, in particular HS1, Crossrail and HS2.

Initially an overview of each project will be presented, then the technical challenges associated with large and dynamic single-phase loads on three phase networks explored in more detail. Finally, they will consider some 'lessons learned' focusing on the testing, commissioning and energisation of these systems.

Reports

Talk and AGM
Tuesday 20th September 2022 - Eastleigh Locomotive Works
Colin Boocock

Colin began his talk by explaining how Eastleigh Locomotive Works came about. Originally the whole of the South East railway network was served by one works at Nine Elms on the outskirts of London, but as can be seen from this picture on the right, taken pre 1909 in the machine shop, it was very congested and somewhat dated with machines being powered by overhead line-shafts.



More significantly, it was not very centrally situated to serve the South East rail network, so a new works was built in a more convenient location at Eastleigh and opened in 1909, followed by the closure and transfer of the workforce from Nine Elms.

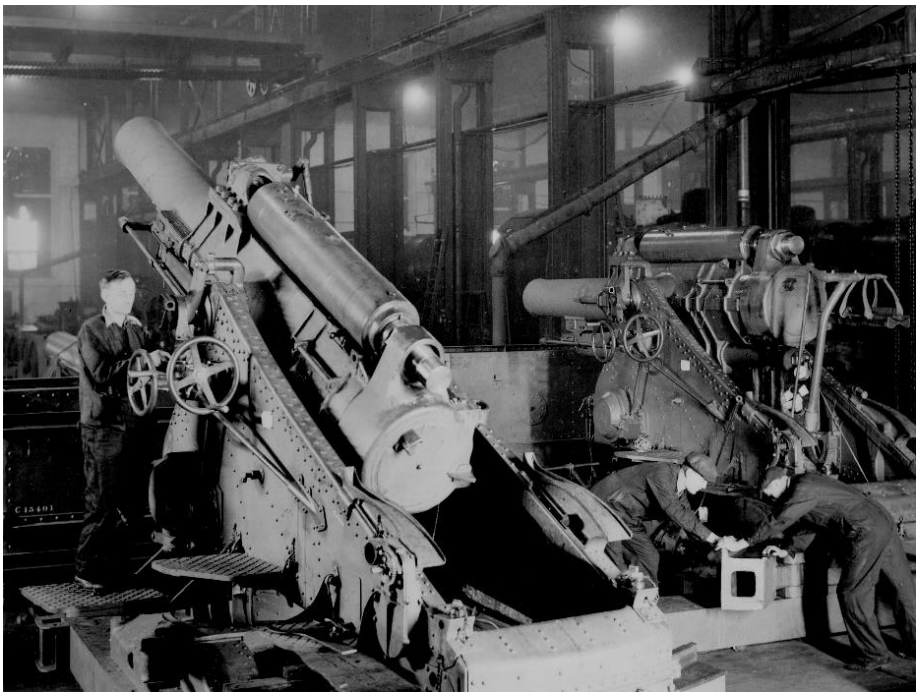
The picture below shows the new works at Eastleigh in 1910 with the four erection shops on the left of the picture.

Eventually Southern Rail took over the Eastleigh works.

During the Second World War, much of the works were given over to the manufacture of armaments, including landing craft and Howitzers as shown in the picture on the right.

In 1948 British Rail took over management of the works.

Colin started work at Eastleigh in 1954 and explained that in its early days, Eastleigh had a drawing office to prepare modifications for steam locomotives, although the actual engines were manufactured elsewhere.



The following two pictures show a panorama view of this busy works in 1960 (top picture) and the casting shop (bottom picture) in the same year. Castings of up to 2.5 tons could be produced at Eastleigh.

During the 60s steam was beginning to give way to diesels and the Beeching report, published in 1963, resulted in a considerable reduction in the scale of the entire railway system.

In 1962 BR Workshops were set up to manage 31 works across the UK, and Eastleigh was provided with a new test house for diesel-electric locomotives.

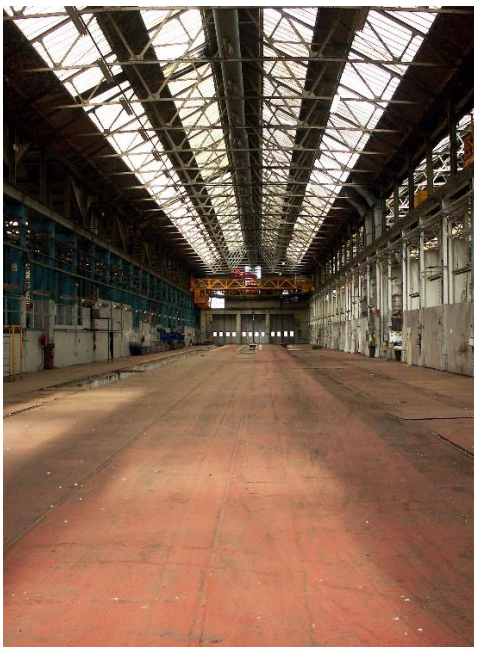
The two pictures below show the Erection shop (left) and the layout of the Carriage Overhaul shop (right), both taken in 1966/67.

Initially the carriage overhaul process had 44 stages and included some wooden frames made from teak.

The iron foundry was closed in 1964 and by 1965 hand painting had been largely replaced by spray painting. The last steam locomotive left the works in December 1966 and in 1967 the number of overhaul stages were halved to 22.

Colin showed pictures of commutator repair of traction motors and rewiring of armatures. During this same period, BREL undertook a review of all workshops and reduced the total from 15 to 8, with Eastleigh being one of the survivors. Overhaul of Multiple Units began at the works, which were then privatised and became part of Wessex Train Care.

Eventually the facility was acquired by Alstom in anticipation of receiving a major contract, which they unfortunately lost to Siemens, and the two pictures below show the last refurbished EMU leaving the works in 2006 (left) and the empty No4 bay in the same year (right).



The future for Eastleigh Locomotive Works looked quite bleak, particularly after the auctioning of most of the plant and equipment by Alstom.

Fortunately, a ‘White Knight’ called appropriately Bruce Knight took over the management of the site leasing space to store and repair locomotives. This resulted in the works remaining open.

Freightliner started to hire the facility and in 2009 the centenary event attracted some 18,000 visitors. The picture on the left shows work taking place on Colas Rail equipment.

Knight's Railway Services Ltd were ultimately bought out by Arlington Fleet Services and are now used by Siemens for overhauls.

Our thanks to Colin for an interesting talk on the Eastleigh Locomotive Works.
Malcolm Hind

Talk
Tuesday 11th October 2022 – Ammonia (NH3), a Future Fuel for Commercial Power Units
Jean-Pierre Pirault

Our speaker, Jean-Pierre, is an engineer with an extensive career in the automotive industry, and although retired, is currently operating Sirius Powertrain Ltd, a small locally-based R&D company working on engines, compressors, mechanisms, and evaporative cooling, which he also discusses at the end of his talk on Ammonia.

He also stated that the foils shown during the talk are for the eyes of members only and must not be reproduced or used outside the confines of the Newsletter and RCEA (Worthing) members. Some have been taken from public domain documents with references to their ownership and source, but without copyright permission. In case of any issues with this restricted publication, the copyright owners should contact the author, namely jppirault30@gmail.com.

Members are asked to treat this limitation rigorously so that we can claim to have taken all reasonable steps to prevent proliferation.

Ammonia (NH3), a Future Fuel for Commercial Power Units

Jean-Pierre began his talk by explaining that it is likely that ammonia would only ever be used as a fuel for commercial applications in, for example, agriculture, marine use, and auxiliary power units where its use can be tightly controlled due primarily to its toxicity.

It could also be used as a fuel source for fuel cells as it is carbon free.

As we are all aware, in order to reduce global warming, the world must reduce its dependency upon carbon-containing fuels, and he presented the table on the right showing the world's continuing use of hydrocarbons.

(An EJ is an ECA Joule, which is 10^{18} Joules.)

The Energy Challenge

Table 1: Primary energy and renewables capacity, 2019

Energy source	Units	World	China	USA	India	UK
Oil	EJ	193.0	27.9	37.0	10.2	3.1
Natural gas	EJ	141.4	11.1	30.5	2.2	2.8
Coal	EJ	158.0	81.7	11.3	18.6	0.3
Total fossil fuel	EJ	492.4	120.7	78.8	31.0	6.2
Actual delivered wind	EJ	5.1	1.5	1.1	0.2	0.2
Actual delivered solar	EJ	2.6	0.8	0.4	0.2	0.0
Nuclear	EJ	24.9	3.1	7.6	0.4	0.5
Hydro	EJ	37.7	11.3	2.4	1.4	0.1
Other*	EJ	21.3	4.3	4.4	0.8	0.8
Total primary energy	EJ	584.0	141.7	94.7	34.0	7.8
Total electricity generated	EJ	97.2	27.0	15.8	5.6	1.2

Source : Global Warming Policy Foundation, Briefing 55, 2021

Electricity accounts for 17% of world energy production

Although the long-term goal is to get to net zero carbon, including a target of limiting the global temperature increase to 1.5ºC, achievement of this goal will have significant consequences, including increases in energy, carbon footprints and use of both common and rare materials.

UK Energy Supply for Net Zero by 2050

There is no one solution to achieving this goal, and all potential solutions involve trade-offs.

As an example of some of the trade-offs, Jean Pierre showed the situation in the UK if we were to rely solely upon green sources for our electricity as shown in the picture on the left.

Staying with wind turbines for a moment, the picture on the right shows the materials required to construct 10 wind turbines – just imagine what would be required for 18,000 of them.

UK Material for x10 Wind Turbine Capacity

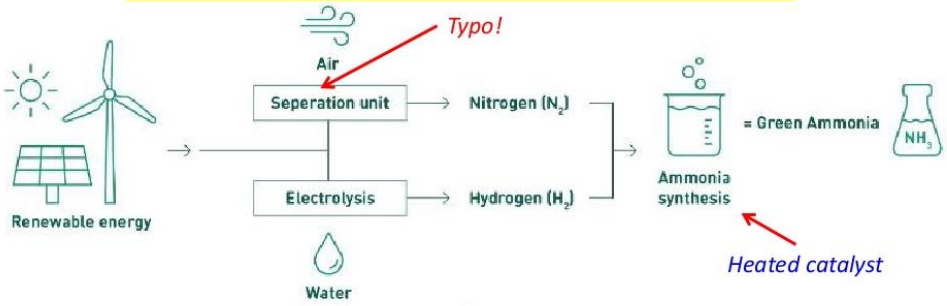
Material	Million tonnes
Steel	32
Concrete	150
Copper	0.9
Rare earths	0.014
Fibreglass	2.1
Other plastics and aluminium	2.8

Source : Global Warming Policy Foundation, Briefing 55, 2021

Implication: enormous net carbon increase, globally, in order to realize electrical energy assumptions for COP26

Ammonia may form part of the solution, but even here there are many obstacles to be overcome as our speaker now discusses.

Green Ammonia Production



Source : Stamicarbon, Netherlands, https://stamicarbon.com

Also: Norway, https://info.topsoe.com> green-ammonia , https://yara.com>corporate-releases/green-ammonia etc

Ref: https://royalsociety.org/topics-policy/projects/low-carbon-energy-programme/green-ammonia/

Implication: high energy input...high costs...but a safe transportable fuel, available ca.2025

Ammonia is still produced industrially today by the Haber-Bosch process and is predominantly used as an intermediary in the manufacture of fertilisers and explosives. The process is not itself green, but much research is underway to generate 'green' ammonia by electrolysis as shown right. There are however significant cost problems to overcome, and commercial production of green ammonia is not expected to begin before 2025.

Even when we are able to produce green ammonia commercially, its use as an alternative fuel source is not straight forward as the table overpage shows.

Commercial Fuels Characteristics

Alternative fuels

Properties

Energy storage type	Specific Energy MJ/kg	Energy Density MJ/L	Required Tank Volume m³ [1]	Supply pressure bar	Injection pressure bar	Tank-to-wake Emission Reduction Compared To HFO Tier II				LCV/kg-air Stoichiomet. [3] MJ/kg
						SO_x	NO_x	CO2	PM	
MCO	42,7	36,9	1000	7-8	950					3
Liquefied natural gas (LNG -162 °C)	50,0	22,4	1602	300	300	90-99%	20-30%	24%	90%	2.9
Liquid ethane gas (LEG -88 °C)	47,5	17,1	2099	380	380	90-97%	30-50%	15%	90%	3
liquefied petroleum gas (LPG -42.4 °C)	46,0	23,5	1527	53	600-700	90-100%	10-15%	13-18%	90%	3
Methanol	19.9	15,8	2272	13	500	90-97%	30-50%	11%	90%	3,3
Ammonia [2] (liquid -33 °C)	18,6	11,5	3121	83	600-700	100%	tna	>95%	>90%	3,1
Hydrogen (liquid -253 °C)	120	8,5	4223							1,7

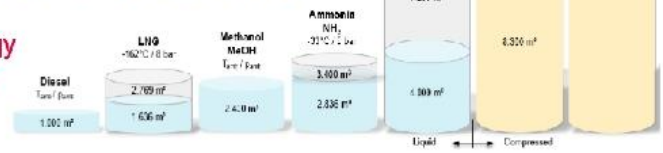
Why not 10 bar?

1: Given a 1000 m³ tank for MCO. Additional space for insulation is not calculated for in above diagram. All pressure values given a high pressure Diesel injection principle

2 Ammonia can be stored at pressurized tanks (~ 18bar) at ambient temperature or at atmospheric pressure at -33°C

3 With the exception of Hydrogen, all fuels are comparable in terms of the LCV of the mixture fuel-air stoichiometric. This leads to a similar amount of energy released per air mass. Hence, thermodynamical layout of the engines in terms of compression volume, turbocharger matching, etc. can stay unchanged for all the fuels on the list

Comparison of storage volume for the same energy amount and additional space for cylindric shaped tanks of cryogenic fuels



MAN Energy Solutions Public: September 2022 11

As can be seen from the above table, compared to Marine Gas Oil (MGO), ammonia has a much lower energy density and requires about 3 times the storage volume. It should also be noted that hydrogen, although having a higher energy density than MGO, requires even larger tanks for its storage.

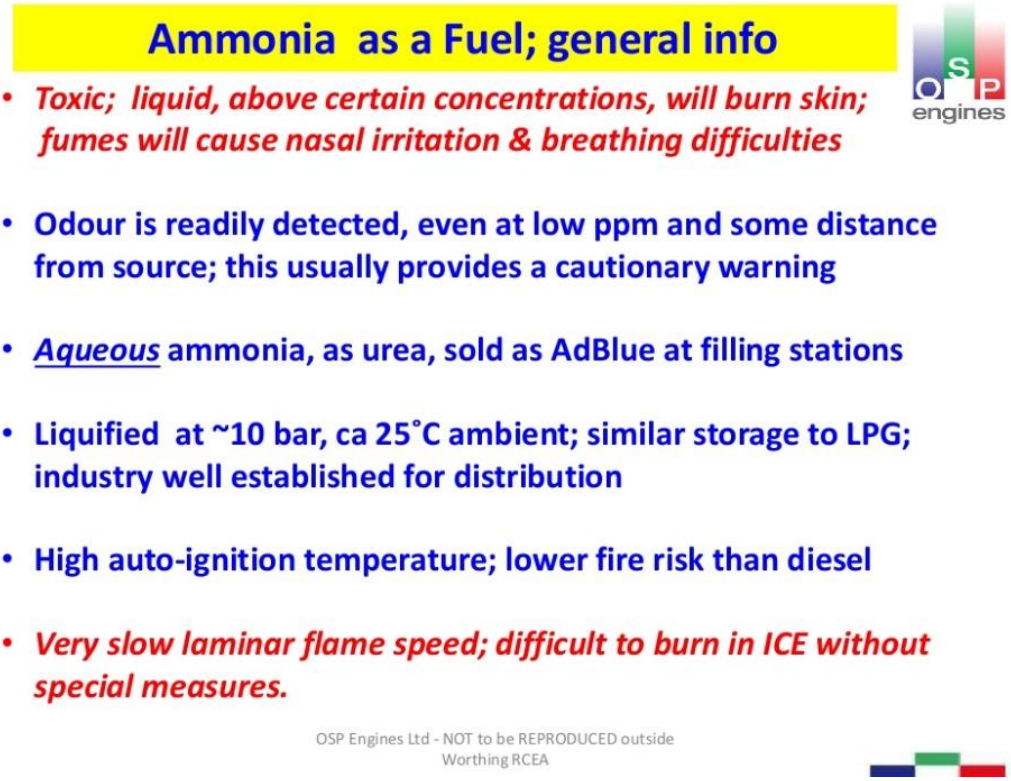
Ammonia has another significant problem when used in an ICE engine, that of getting it to ignite as can be seen from the table below.

Future Fuel Characteristics

Table 1. Ammonia properties and comparison with other fuels at 300 K and 0.1 MPa, unless stated otherwise. Data from [5–7].

Species	Ammonia	Methanol	Hydrogen	Methane	Gasoline
Formula	NH_3	CH_3OH	H_2	CH_4	-
Storage	Liquid	Liquid	Compressed	Compressed	Liquid
Storage temperature (K)	300	300	300	300	300
Storage pressure (MPa)	1.1	0.1	70	25	0.1
ρ @ storage conditions ($kg.m^{-3}$)	600	784.6	39.1	187	~740
LHV (MJ/kg)	18.8	19.9	120	50	44.5
LBV @ $\phi = 1$ ($m.s^{-1}$)	0.07	0.36	3.51	0.38	0.58
Auto-ignition temperature (K)	930	712	773-850	859	503
Research Octane Number	130	119	>100	120	90-98
FL in air (vol.%)	15-28	6.7-36	4.7-75	5-15	0.6-8

Difficult to ignite!!! Slow start of combustion



Despite the hurdles, research is ongoing to overcome the ignition problems associated with ammonia, possibly by doping with low concentrations of hydrogen, and reducing the concentrations of NOX in the exhaust.

Jean Pierre concluded this part of his talk by presenting the information on the right as a summary of ammonia as a fuel.

He then turned his talk over to Opposed Piston Engines with which he has had a close connection over many years.

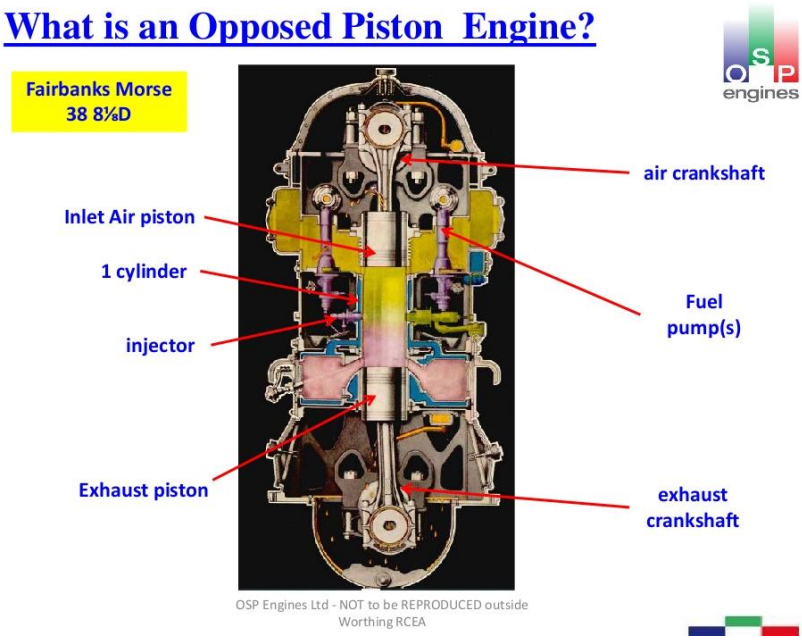
Opposed Piston Engines

Jean Pierre introduced the Opposed Piston (OP) engine shown on the right.

The engine has no cylinder head as in a conventional ICE engine, with the combustion chamber being formed between the tops of the two opposed pistons and the cylinder sleeve.

In the illustration shown the upper piston provides the combustion air and the lower one deals with the exhaust gases. Both pistons provide power and the two crankshafts are geared together such that the engine is a two stroke with one power stroke every revolution.

Air and exhaust gases travel through the engine via ports in the cylinder sleeve which is covered/uncovered by the piston skirts.



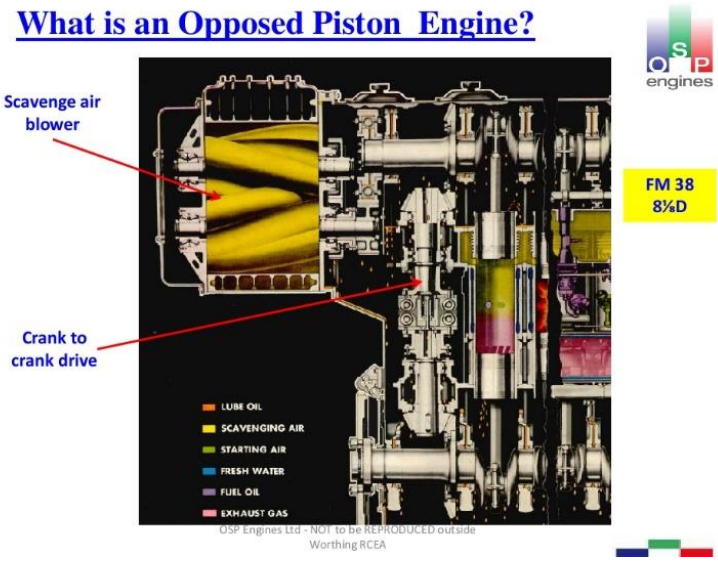
Although the OP engine is probably not very familiar to the majority of automotive engineers, it has a very long history in marine use, stationary engines and even in locomotives as shown in the illustration on the left.

Readers will have noticed the reference to the American company Fairbanks Morse in both pictures of the OP engine. This company was one of the early pioneers in the development of this engine, originally introducing early versions of it in 1939 for use in submarines.

As with all two stroke engines, the inlet air/gas mixture needs to be pressurized in order to scavenge the combustion chamber of exhaust gases.

Pressurization can be accomplished in a number of ways, and the illustration on the right shows the system used by Fairbanks Morse using a Roots blower gear-driven from one of the crankshafts.

There are alternative methods, and our speaker went on to discuss some current experimental work that he himself is involved in based upon a stepped piston engine.



Stepped Piston Engines

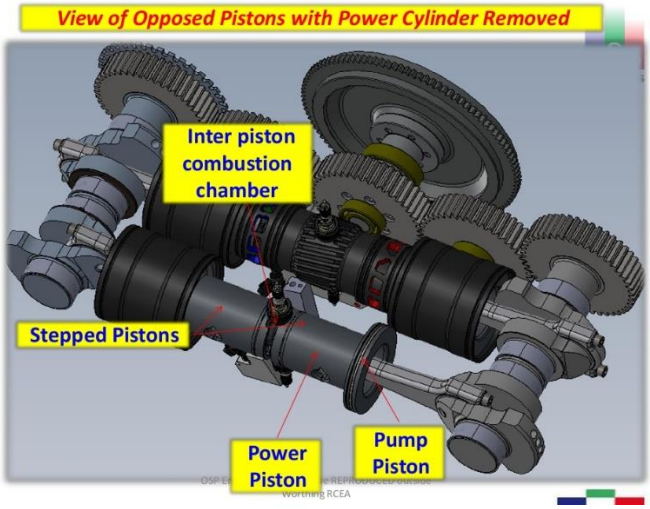
Jean-Pierre showed on the right some of the internal components of a stepped piston engine and in fact circulated some actual component parts for us to examine during his talk. The piston has two sets of piston rings of very different diameters, the larger one being used purely for compressing the air/fuel mixture for subsequent transfer to the cylinder.

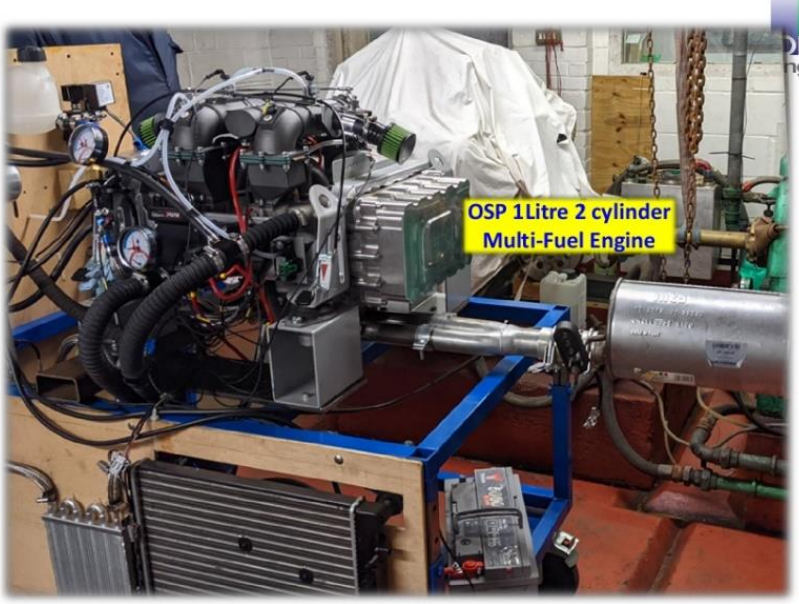
Apparently getting small batches of such prototype pistons manufactured to the required tolerances is proving quite difficult.

The illustration on the right shows how a stepped piston could be incorporated in a twin cylinder OP engine.

The speaker discussed more details of how such an engine could be adapted to burn fuels other than Marine Gas Oil (MGO, including ammonia which readers will recall has particular issues associated with its higher ignition temperature and low laminar flame speed.

He discussed potential solutions to the use of ammonia including adaptations to the top of the piston to induce swirl and a squish area to raise the compression ratio locally in order to encourage combustion to start.

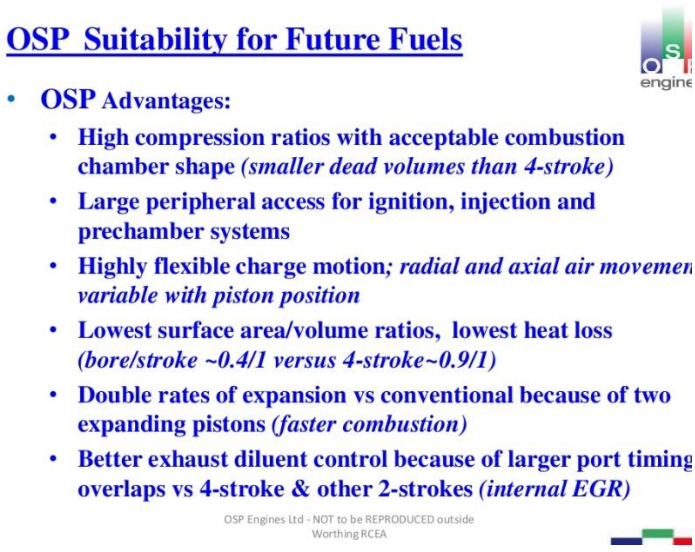




OSP Engines Ltd - NOT to be REPRODUCED outside Worthing RCEA

The picture on the left shows the current prototype engine on test at the premises of OSP Engines Ltd.

In this slide on the right, Jean-Pierre listed the potential benefits that an OP engine could provide for future fuels.



Our speaker concluded his talk with a prediction for the future shown left.

Following this talk, our attention has also been drawn to an article in the November 2022 edition of Electric and Hybrid Marine technology international magazine, stating, inter alia, 'Maritime classification society Lloyd's Register has been selected to undertake feasibility studies in the Pilbara region of Western Australia into the potential use of clean ammonia at ports in the area to refuel ships'.

Clearly this is seen as a subject worthy of further investment for potential marine use.

We are very grateful to our speaker, Jean-Pierre, who stepped in at very short notice to provide us with such an interesting and wide-ranging talk.

Talk
Tuesday 8th November 2022 – Geology Investigation Practice
Roger Smith

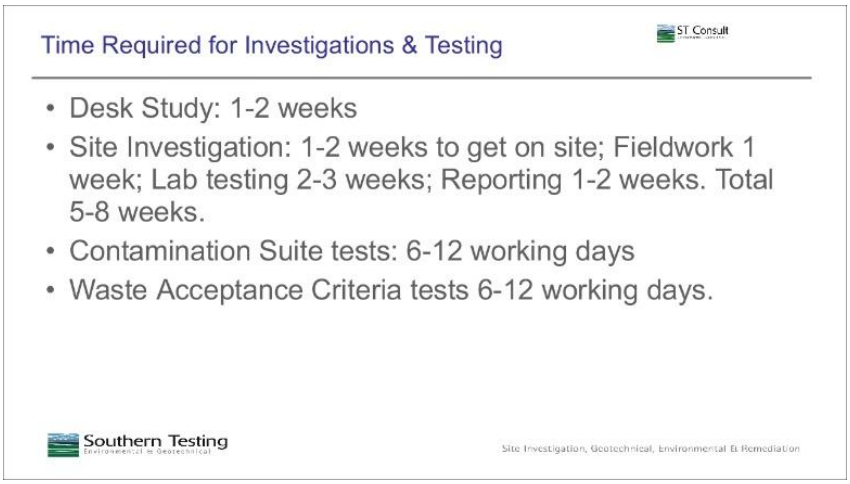
Members will recall that this is the second time that we have welcomed our speaker, Roger Smith, to the RCEA. He is a Chartered Geologist with a specialism in Engineering Geology, Contaminated Land & Remediation. He worked for Southern Testing in East Grinstead for many years, and has also spent some time in Hong Kong and other countries.
Roger explained that Southern Testing, employing some 27 professional engineers and 12 field engineers, has extensive expertise in this field and also operates a very well-equipped Geotechnical laboratory as shown on the right.

Although no two projects are the same, the general approach is to start with a desk study of existing site information, often using OS maps which in some cases go back to 1860, followed by the digging of trial pits and bore holes to more accurately measure ground conditions, and then to carry out additional testing as dictated by the findings so far.

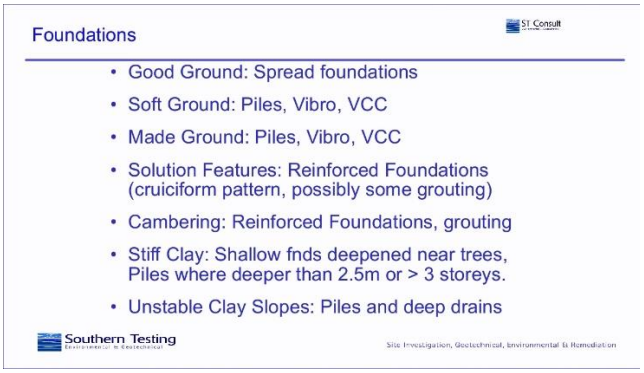
All of the work has to be executed in accordance with a number of standards and published guidance, which Roger described in his talk.

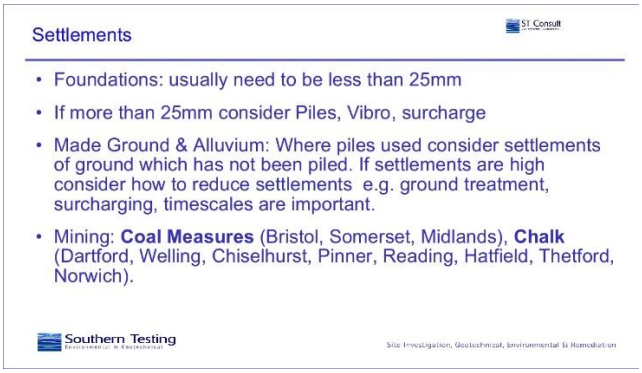
Shown left is one of the smaller boring machines, capable of deployment in cramped sites.

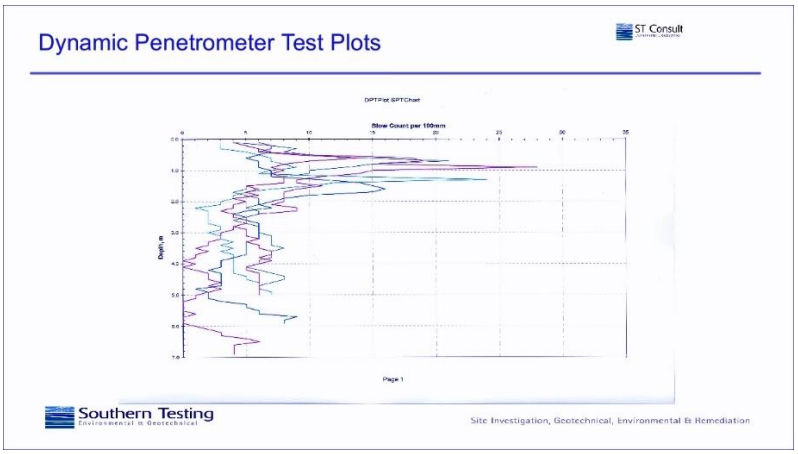
Roger then talked about typical timescales (see slide right) for the various phases of a project, culminating in the issue of a detailed report to the client, often containing suggestions for further work dependent upon the initial findings and the nature of the intended construction on the land.



One of the first considerations in any construction project is the size and type of foundations required, and he tabled the two slides below showing the choice of foundations and the effect of settlement on this choice. Surcharging involves pre-loading the ground prior to commencing construction to encourage the ground to settle. It may take many months to achieve stability under the imposed pre-load.







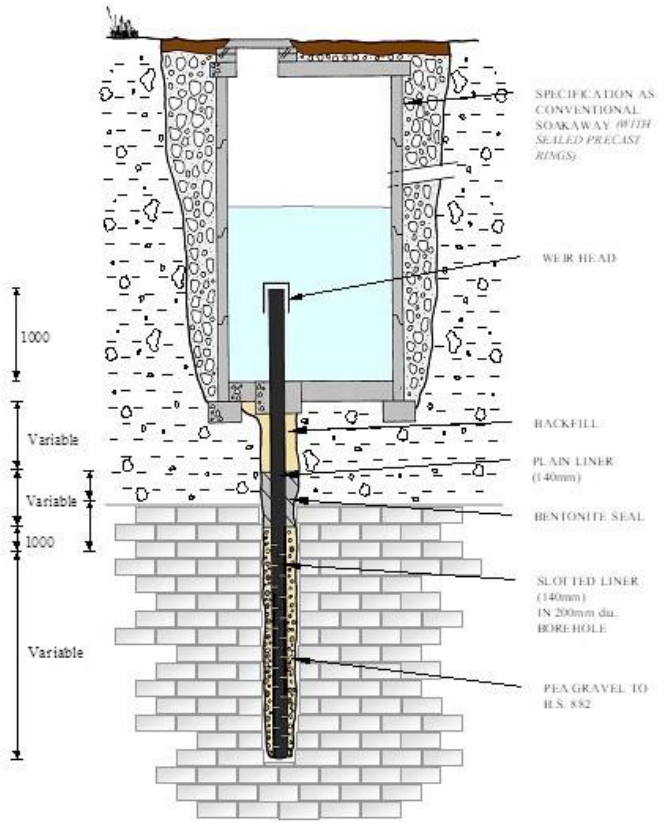
In cases where it is suspected that ground conditions may constitute a problem, Dynamic Penetrometer tests are carried out by counting the number of blows required to sink the instrument's head into the ground by 100mm.

The standard instrument consists of a hardened conical tip, standard diameter steel rod and an 8 Kg hammer which is dropped from the top of the rod against an anvil to advance the tip into the ground.

A series of test plots are shown on the slide on the left.

Another situation when additional testing is required is when site drainage is a concern, and here one or more boreholes are sunk to measure the ability of water to soak away into the sub-surface following heavy rain.

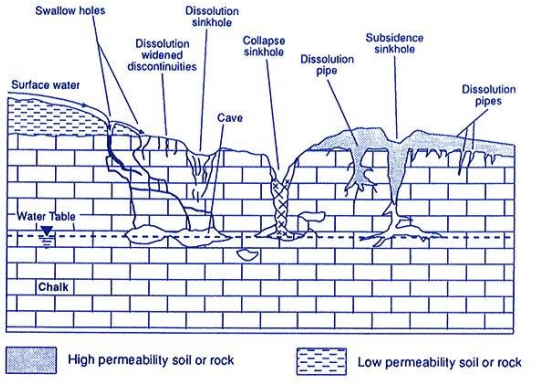
The diagram on the right illustrates such a test.



Roger then re-introduced us to the subject of Solution Features (or dissolution features) where surface water runoff, which is slightly acidic, has discharged into and dissolved the underlying chalk (calcium carbonate). Following this the dissolved zone becomes infilled with loose soils which, if inundated, will subside.

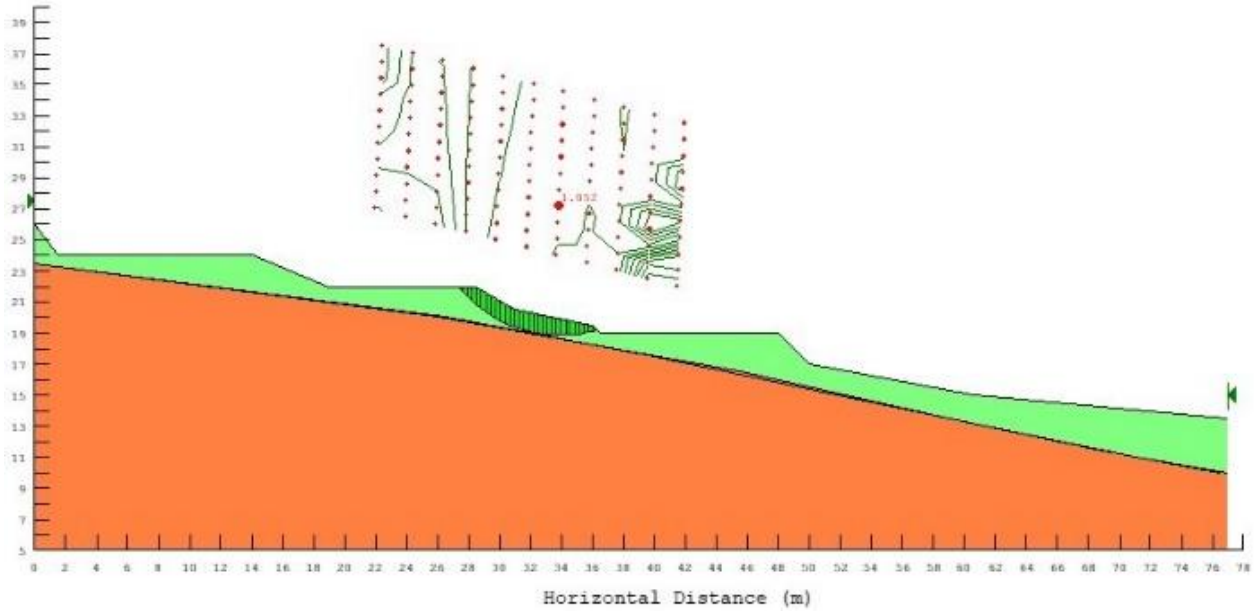
Areas of high risk often occur where there is a cover of clay strata, including most areas where Chalk outcropped. Sussex, in particular near Chichester, is regarded as a high-risk area.

The pictures below show how such features develop (left) and the results at the surface (right) when subsidence does occur.



Schematic illustration of common dissolution feature types developed in calcium carbonate rich chalks (based on Applied Geology, 1993)

Roger concluded his talk by covering landslips, where whole sections of land move (see graph below), often during periods of heavy rain, sometimes causing significant damage to any buildings in their vicinity. The pictures below show on the left the cause of the Frankland village landslip, and on the right, the resulting damage to houses.



The speaker's talk raised a number of questions from the audience which Roger answered after the break. We are very grateful for such an interesting talk on this subject and thank our speaker for both visits to the RCEA.

Malcolm Hind

End of Newsletter